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**(54) HARMFUL MATTER ADSORBING AND REMOVING AGENT**

(57)Abstract:  
PROBLEM TO BE SOLVED: To provide an agent capable of adsorbing and removing a harmful matter depositing on or contained in food, etc., or present in a digestive system at an extremely high rate by bringing the agent in direct contact with food, etc., and giving the agent directly in the digestive system.  
SOLUTION: An activated carbon having 5 $\mu$ m to 10mm grain diameter is dispersed by 0.02-90wt.% in a physiologically allowable gel dispersion medium such as the bivalent metal salt of a high molecular polycarboxylic acid, bean curd, jelly, konjak, snow bell, gelidium jelly and chitosan-oxalate gel to obtain the harmful matter adsorbing and removing agent. Accordingly, the agent is useful in adsorbing and removing the food additive, feed additive, agricultural chemical, natural poison, allergen, heavy metal, highly poisonous org. compd., etc., depositing on or contained in food, etc., the excess nutrient present in the digestive system and the intermediate metabolite of alcohol, etc., formed in the digestive system after drinking alcohol.

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CLAIMS

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[Claim(s)]

[Claim 1] The adsorption-treatment agent of a toxic substance which makes it come 0.02 to 90% of the weight to distribute activated carbon with a particle size of 5 micrometers - 10mm in the gel dispersion medium permitted physiologically.

[Claim 2] The adsorption-treatment agent of the toxic substance according to claim 1 whose gel dispersion medium permitted by the aforementioned physiology target is the divalent-metal salt of a macromolecule polycarboxylic acid.

[Claim 3] The adsorption-treatment agent of the toxic substance according to claim 2 whose divalent-metal salt of the aforementioned macromolecule polycarboxylic acid is a calcium salt.

[Claim 4] The adsorption-treatment agent of the toxic substance according to claim 2 whose divalent-metal salt of the aforementioned macromolecule polycarboxylic acid is the calcium alginate.

[Claim 5] The adsorption-treatment agent of the toxic substance according to claim 1 whose gel dispersion medium permitted by the aforementioned physiology target is tofu, jelly, konnyaku, an agar, ego, a gelidium jelly, or chitosan oxalate gel.

[Claim 6] The adsorption-treatment agent of the toxic substance according to claim 1 to 5 which is the food additive taken in in the digestive system or the aforementioned toxic substance adhered or contained in food or feed, a feed additive, agricultural chemicals, naturally occurring poison, allergen, heavy metal, or a strong toxic organic compound.

[Claim 7] The adsorption-treatment agent of the toxic substance according to claim 1 to 5 which is the surplus nutrient with which the aforementioned toxic substance was taken in in the digestive system.

[Claim 8] The adsorption-treatment agent of the toxic substance according to claim 1 to 5 which is the intermediate product of the alcohol which the aforementioned toxic substance generates in an after [alcoholic ingestion] digestive system.

[Claim 9] The processed food or feed which mixed the adsorption-treatment agent of a toxic substance according to claim 1 to 8 0.01 to 60% of the weight.

[Claim 10] The processed food or feed which mixed activated carbon with a particle size of 5 micrometers - 0.5mm 0.02 to 60% of the weight.

[Claim 11] The processed food according to claim 9 or 10 which are dairy products, fishery boiled fish paste, a fish-and-shellfishes workpiece, meat products, a beans product, a vegetable workpiece, a potato workpiece, a grain workpiece, sweet taste, fats and oils, or confectionary.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Or it adheres or contains this invention for food etc., it relates to the adsorption-treatment agent of the toxic substance which exists in a digestive system.

[0002]

[Description of the Prior Art] Activated carbon shows adsorption capacity with it, and is used for various uses as a typical adsorbent. [ a large specific surface area and ] [ high ] However, the example which used the adsorption-treatment agent of a toxic substance which distributed activated carbon in the gel matter or the solid food article in the mode prescribed for the patient into a direct digestive system or it makes direct food etc. contact is not found.

[0003]

[Problem(s) to be Solved by the Invention] Although movement into the cell of activated carbon and incorporation did not happen, in the culture examination of the plant cell under existence of particle activated carbon, they checked that activated carbon became a nucleus and a cell cluster was formed, so that this invention persons might mention later. Although particle activated carbon is not incorporated in each cell in a digestive system, this is easy to be incorporated in the intercellular-space matter, in case a cell forms a colony, and suggests a bird clapper, saying that it is difficult to separate particle activated carbon from a cell colony. Moreover, it is also known by the protein or glycoprotein of a cell membrane outer layer for the animal cell that particle activated carbon will adsorb. Therefore, when particle activated carbon is prescribed for the patient into a direct digestive system as an adsorption-treatment agent of a toxic substance, it is thought very difficult to make this discharge out of a digestive system completely.

[0004] The result which repeated research wholeheartedly about the adsorption-treatment agent of the toxic substance which this invention persons can prescribe for the patient into a direct digestive system, What carried out distributed content of the particle activated carbon into the gel matter permitted physiologically or the solid food article It had very high adsorption capacity to various toxic substances, and moreover, it knew it being easily discharged out of a digestive system, and getting, without adsorbing the protein or glycoprotein of a cell membrane outer layer, when these are directly prescribed for the patient into a digestive system, and this invention was completed.

[0005] By making direct food etc. contact or prescribing a medicine for the patient into a direct digestive system, or it adheres or contains the purpose of this invention for food etc., it is to offer the adsorption-treatment agent of the toxic substance which can carry out the adsorption treatment of the toxic substance which exists in a digestive system to high rate extremely.

[0006]

[Means for Solving the Problem] this invention relates to the adsorption-treatment agent of a toxic substance which makes it come 0.02 to 90% of the weight to distribute activated carbon with a particle size of 5 micrometers - 10mm in the gel dispersion medium permitted physiologically.

[0007] Since the adsorption-treatment agent of the toxic substance of this invention consists of a

dispersed system which distributed particle activated carbon uniformly in the gel dispersion medium, the effective adsorption area as the whole adsorbent increases, adsorption capacity increases, and it can carry out the adsorption treatment of the toxic substance to high rate extremely rather than it uses it by the activated carbon independent.

[0008] Moreover, since the adsorption-treatment agent of the toxic substance of this invention is making the gel matter permitted physiologically carry out distributed content of the particle activated carbon, it can be directly prescribed for the patient into a digestive system, and can carry out the adsorption treatment of the toxic substance which was mixed in food etc. and taken in in the digestive system simple into a digestive system. And the adsorbent after carrying out the adsorption treatment of the toxic substance in a digestive system is easily discharged out of a digestive system very promptly, and it deals in it.

[0009] Moreover, the adsorption-treatment agent of the toxic substance of this invention can also carry out the adsorption treatment of the toxic substance which food etc. is made to carry out mixed contact and is contained in food etc. In this case, compared with the case where activated carbon is used independently, the adsorbent after an adsorption treatment is [ a toxic substance ] easily separable from food in a short time. Furthermore, though it mixes in food etc., without separating an adsorbent accidentally and is taken in in a digestive system, since it is quickly discharged out of a digestive system as mentioned above, it is safety.

[0010] Prescribe the adsorption-treatment agent of the toxic substance of this invention for the patient directly into a digestive system as mentioned above, and it is used, and also it can also be mixed and used for a processed food etc. Moreover, the same effect as the adsorption-treatment agent of the toxic substance of this invention is acquired also by mixing activated carbon in a processed food etc. directly.

[0011] It can use to a man as an adsorption-treatment agent of the matter detrimental to a human body, and also the adsorption-treatment agent of the toxic substance of this invention can be used to a feeding animal. That is, it can prescribe a medicine for the patient and use for a feeding animal by processing feed using the adsorption-treatment agent of this invention, or mixing the adsorption-treatment agent of this invention in direct or feed.

[0012]

[Embodiments of the Invention] One of this inventions is an adsorption-treatment agent of a toxic substance which makes it come 0.02 to 90% of the weight to distribute activated carbon with a particle size of 5 micrometers - 10mm in the gel dispersion medium permitted physiologically.

[0013] The particle size of the activated carbon used in the adsorption-treatment agent of the toxic substance of this invention has 5 micrometers - 10 goodmm. By less than 5 micrometers, handling becomes [ the particle size of activated carbon ] difficulty, and if it exceeds 10mm, the adsorption capacity per unit weight of activated carbon will fall.

[0014] Moreover, the amount of mixtures of the activated carbon to the inside of a dispersion medium has 0.02 - 90 good % of the weight. If the amount of mixtures of an adsorption effect of activated carbon is low at less than 0.02 % of the weight and it exceeds 90 % of the weight, it will become difficult to distribute gel distribution double Naka.

[0015] As a gel dispersion medium which is used in the adsorption-treatment agent of the toxic substance of this invention and which is permitted physiologically, even if it prescribes a medicine for the patient into a digestive system, the harmless gel matter, for example, the divalent-metal salt of a macromolecule polycarboxylic acid, is mentioned. As a divalent-metal salt of a macromolecule polycarboxylic acid, the calcium of the high molecular compound which has a carboxyl group, magnesium, iron, a copper salt, etc. are mentioned to side chains, such as an alginic-acid, pectic-acid, carboxymethyl-cellulose, carboxymethyl chitin, styrene-maleic-acid copolymer, styrene-maleic-acid half alkyl ester copolymer, ethylene-acrylic-acid copolymer, polyacrylic-acid, polymethacrylic-acid, and acrylic-acid-methacrylic-acid copolymer, an acrylic-acid-maleic-acid copolymer, and an acrylic-acid-maleic-acid half alkyl ester copolymer.

[0016] The adsorption-treatment agent using the divalent-metal salt of a macromolecule polycarboxylic

acid is obtained by dropping the suspension of the alkali-metal salt of a macromolecule polycarboxylic acid or an ammonium salt, and activated carbon into a divalent-metal salt water solution. The concentration of the alkali-metal salt of the macromolecule polycarboxylic acid of the above-mentioned suspension or an ammonium salt has good 0.01-5 mols, when the firm gel which distributes activated carbon under at a minimum is not obtained but an upper limit is exceeded, there are many macromolecule polycarboxylic-acid salts which surround activated carbon, penetration inside [ of an adsorbed object ] an adsorbent is checked, and adsorption capacity falls remarkably. Moreover, the concentration of a divalent-metal salt water solution has good 0.05-5 mols, the intensity of an adsorbent becomes weak, the rate of bridge formation exceeding an upper limit becomes large, the aperture of an adsorbent becomes [ the rate of bridge formation ] few very small, and an adsorbent-ed stops being able to advance inside an adsorbent under at a minimum easily.

[0017] Moreover, in this invention, gel food, such as tofu, jelly, konnyaku, an agar, ego, or a gelidium jelly, chitosan oxalate gel, etc. can also be used as a gel dispersion medium permitted physiologically. The adsorption-treatment agent using these dispersion media is obtained by adding activated carbon suitably and making it distribute before gel formation in the manufacture process of each gel food.

[0018] Or it contains the adsorption-treatment agent of the toxic substance of this invention in food or feed, it can use the food additive taken in in the digestive system, a feed additive, agricultural chemicals, naturally occurring poison, allergen, heavy metal, a strong toxic organic compound, etc. for carrying out an adsorption treatment. As a food additive, saccharin and its salts, glycyrrhizinic acid 2 potassium, Sweeteners, such as glycyrrhizinic acid 3 potassium and an ethyl acetoacetate, an iron sesquioxide, The edible red No. 3, No. 40, No. 102, No. 104, No. 105, No. 106, Colorants, such as the Tartrazine, No. 5, the edible green No. 3, the edible blue No. 1, No. 2, and a titanium dioxide, A benzoic acid, orthophenyl phenol, a sorbic acid, a dehydroacetic acid, Propionic acids and those salts, diphenyl, a thiabendazole, Quality hold-back agents, such as preservatives, such as paraoxybenzoic acids, and a propylene glycol, A propylene glycol alginate, a carboxymethyl-cellulose potassium, Carboxymethylcellulose sodium, starch glycolic-acid sodium, A thickener, a stabilizer, a gelling agent, and thickening agents, such as starch phosphoric ester sodium, a methyl cellulose, and sodium polyacrylate, An dl-alpha tocopherol, a NIRISORUBIN acid, and its sodium salt, GUAYAKU fat, a citric-acid isopropyl, a dibutyl hydroxy toluene, Nordihydroguaiaretic acid, butylhydroxyanisole, a propyl gallate, Antioxidants, such as ethylenediaminetetraacetic acid calcium disodium and a disodium ethylenediaminetetraacetate, Color couplers, such as a sodium nitrite, a potassium nitrate, a sodium nitrate, a ferrous sulfate, and phosphate, Hormone, such as mildewproofing and antibacterials, such as bleaching agents, such as germicides, such as a hydrogen peroxide, a hypochlorous acid, and a sodium hypochlorite, a sulfurous acid, and its salts, orthophenyl phenol and its salts, diphenyl, and a thiabendazole, and a female sex hormone, etc. is mentioned. As agricultural chemicals, MEP, diazinon, PAP and IBP, EDDP, Organic phosphorus, such as DDVP, DEP, marathon, and EPN, chloro SARONIRU, Chloropicrin, D-D, pyrazolate, PCNB, a hula side, DCIP, Organic chlorine, such as pro SHIMIDON, BMC, MTMC, XMC, MCC, Benzimidazoles, such as organic bromines, such as carver mates, such as MIPC, and a methyl bromide, and thiophanate-methyl, Diphenyl ethers, such as thio carver mates, such as benthocarb, and CNP, Dithio carbamates, such as phthalimides, such as chlorine, such as a chlorate, and captan, and MANNEBU, Germicides, such as copper, such as acid amides, such as diphenyl ethers, such as BIPIRIJUMU, such as a paraquat, and a chlormethoxynil, and DCPA, and inorganic copper, SETOKISHIJIMU, isoprothiolane, Probenazole, dymron, and naproanilide, an insecticide, a herbicide, etc. are mentioned. As naturally occurring poison, the solanine contained in the sprout of a potato, alkaloid, a hydrocyanic acid glycoside, etc. are mentioned. The histamine which caused the method food poisoning of allergy and is generated by decomposition of meat etc. as allergen is mentioned. As a heavy metal, mercury, lead, hexagon-head chromium, cadmium, a selenium, an arsenic, copper, iron, zinc, etc. are mentioned. Moreover, a phosphide, a chloride, benzene, etc. are mentioned as a strong toxic organic compound. [0019] Moreover, the adsorption-treatment agent of the toxic substance of this invention can use the surplus nutrient taken in in the digestive system also for carrying out an adsorption treatment. By

adsorbing the nutrient in a culture medium in a cell culture examination, the adsorption-treatment agent of this invention has the work which suppresses the proliferation of cells, by taking in to time before a meal or after a meal together with food etc., can suppress metabolism, such as food, and can use it also as an anti-overweight agent etc. so that it may mention later.

[0020] Furthermore, the adsorption-treatment agent of the toxic substance of this invention can use the acetaldehyde which is the intermediary-metabolism object of the alcohol generated in an after [ drinking ] digestive system for carrying out an adsorption treatment. That is, the alcoholic (ethyl alcohol) intermediary-metabolism advances gradually, and generates an acetaldehyde as an intermediary-metabolism object, and, subsequently to an acetic acid and an acetyl CoA, an acetaldehyde oxidizes. In these alcoholic metabolism, if the concentration of an acetaldehyde becomes high, symptoms (acetaldehyde symptom), such as \*\*\*\*, vomiting, a face flush, an increase in a heartbeat, pulsation nature headache, a skin temperature rise, and a lowest-blood-pressure fall, will happen. Therefore, these acetaldehyde symptoms can be prevented or treated by carrying out the adsorption treatment of the acetaldehyde which takes in the adsorbent of this invention before and after it in the case of drinking, and is generated in a digestive system. Moreover, the poisoning symptom by the misuse of a methanol etc. originates in the intermediary-metabolism object of the alcohol, and it can use also for the medical treatment of these ACHIDOSHISU.

[0021] Other one of this inventions is the processed food or feed which mixed the adsorption-treatment agent of the above-mentioned toxic substance 0.01 to 60% of the weight.

[0022] The amount of mixtures to the processed food of the adsorption-treatment agent of the toxic substance of this invention etc. was made into 0.01 - 60 % of the weight because the feeling or a feeling of a meal as food etc. would not be obtained but foreign body sensation would become severe, if adsorption capacity sufficient at less than 0.01 % of the weight was not obtained but it exceeded 60%.

[0023] as the processed food which mixes an adsorption-treatment agent -- dairy products, such as yogurt and a cheese head, boiled fish paste, a fishcake tube, a light, puffy cake made of ground fish, and deep-fried fish balls, if it becomes Fish-and-shellfishes workpieces, such as fishery boiled fish paste, such as dumplings, and \*\* which does not come out, a sausage, Frankfurt, Meat products, such as liver paste, tofu, broiled tofu, fried bean curd, deep-fried tofu, Vegetable workpieces, such as beans products, such as fried tofu mixed with vegetables, tofu lees, freeze-dried tofu, and soy milk skin, and a puree, Potato workpieces, such as mashed potatoes, waste, strips of bean-jelly, konnyaku, and konnyaku noodles, rice cake, a rice-flour dumpling, a white meal, wheat gluten, rice vermicelli, macaroni, spaghetti, thin wheat noodles, a side, Sweet taste, such as a workpiece of grain, such as Japanese noodles, Chinese-style noodles, bread, a cracker, and AMPAN, and a jam Fats and oils, such as butter, margarine, mayonnaise, and a dressing, a candy, Confectionary, such as steamed filled dumplings, rice-cake-stuffed-with-sweet-beans rice cake, a dumpling, sweet rice paste, chocolate, a biscuit, Cookie, a doughnut, a cake, a pie, ice cream, a pudding, jelly, and Bavarian cream, etc. is mentioned among dried sweetmeats, a rice cracker, hail, sponge cake, sweet bean paste, and \*\*.

[0024] One of this inventions of further others is the processed food or feed which mixed activated carbon with a particle size of 5 micrometers - 0.5mm 0.01 to 60% of the weight.

[0025] By less than 5 micrometers, handling becomes [ the particle size of activated carbon ] difficulty, if it exceeds 0.5mm, the feeling or a feeling of a meal as food etc. will not be obtained, but foreign body sensation will become severe. Moreover, it is based on the same reason as the limit in the processed food of the aforementioned this invention etc. that the amount of mixtures to the processed food of activated carbon etc. is restricted. Moreover, as a processed food which mixes activated carbon, the same thing as the aforementioned processed food is mentioned.

[0026]

[Example]

[Example 1]

4g of activated carbon with a particle size of about 15 micrometers was often mixed with 16g of manufacture fine powder of the konnyaku containing activated carbon, and it heated for about 5 minutes

by high heat, agitating [ small quantity every ] so that a lump may not be made in 750ml of 30-degree C warm water. After air bubbles came to have blown off into small pieces, it was made a medium fire and churning was continued for 7 - 8 minutes, and it cooled to about 40 degrees C after that. What melted CaO which a mortar is sufficient as and was mashed to 50ml of 40-degree C warm water was added to this, the whole was kneaded quickly, and it put into \*\*\*\*, and a finger could be used, and the air inside a presser foot was extracted and it was made homogeneous. It put in into boiling water the whole \*\*\*\*, heated for about 5 minutes, it took out from \*\*\*\*, heating was continued for 25 more minutes, and it was made to solidify completely. Bitter taste is removed by exposing the done konnyaku containing activated carbon to a stream, and it is 3 about 1mm. The fragment was carried out and it considered as the experiment sample.

[0027] [Example 2]

3g of activated carbon with a particle size of about 15 micrometers was often mixed with 2g of manufacture sodium alginates of the alginic-acid calcium gel ball containing activated carbon, it added small quantity every in 800ml of churning sewage, water was added further, and the whole quantity was set to 1000ml. It agitated for further 24 hours and the sodium-alginate solution containing activated carbon was prepared 0.3%. 11.1g of calcium chlorides was independently melted in 800ml of distilled water, distilled water was added further, the weight was set to 1000ml, and the calcium chloride solution was prepared 1.11%.

[0028] Next, the sodium-alginate solution containing activated carbon was poured into the 50ml buret 0.3%, it dropped 1 \*\* at a time into 500ml of 1.11% calcium chloride solutions, and the crude material of the alginic-acid calcium gel ball containing activated carbon was obtained. Having collected the obtained gel balls, having put into the 5l. container, and passing ion exchange water, it processed for 10 hours, the unreacted object and the by-product were removed, and the alginic-acid calcium gel ball containing activated carbon was obtained.

[0029] [Example 3]

Bread-making was carried out over 4 hours and 15 minutes using 400g [ of manufacture strong flour of the bread containing activated carbon ], 4g [ of activated carbon with a particle size of about 15 micrometers ], and butter 15g, skim milk 8g, 10g [ of sugar ], 7g [ of salts ], and dry yeast 4g by the national automatic home bakery ( SD-BT6 by Matsushita Electric Industrial Co., Ltd.). When the obtained bread containing activated carbon was eaten, a feeling of a meal was completely the same as flavor as compared with the case where activated carbon is not put in.

[0030] [Example 4]

It is Catharanthus as an adsorptivity examination model plant cell to the plant cell of various activated carbon particles. 500ml Erlenmeyer flask containing 100ml of culture media performed the cell culture by the rotary shaking culture (120rpm) using the cultured cell of roscus (Madagascar periwinkle). A culture medium is Murashinge. What added Sucrose(sucrose)30 g/l and 2 and 4-D0.5 mg/l which is a plant growth-regulating substance was used for the Skoog (MS) culture medium. The bread containing activated carbon manufactured in the konnyaku containing activated carbon and the example 3 which were manufactured in activated carbon with a large particle size (particle size of about 5mm), activated carbon with a small particle size (particle size of about 15 micrometers), and the example 1 was added so that it might become 1.0% (W/V) to a culture medium, respectively. The amount of multiplication of a cell is Packed. cell volume (" plant cell tissue culture actually a packed-cell-volume method, - application / view first edition" the Harada \*\*\*\* edit, the 55th page, 1993) performed.

[0031] Many plant cells usually exist from dozens rather than a unicellular state in the state of the cell conglomerate constituted in the cell of a-1000 number. As a result of performing microscope observation about a day [ of cultivation / 14th ] cell, as for both the things that added activated carbon with a large particle size, and activated carbon with a small particle size, a part of thing in which activated carbon became a nucleus and formed the cell conglomerate was accepted. On the other hand, in what added the konnyaku containing activated carbon and the bread containing activated carbon of this invention, it hardly accepted.

[0032] Moreover, as for movement of activated carbon to the interior of a cell, and absorption, neither of the cases was accepted. When multiplication of a cell was looked at and activated carbon was added, also in which type, multiplication of a cell was checked about 30%. The nutrient in a culture medium sticks to activated carbon, and this phenomenon is considered to be what was produced since nutrients ran short.

[0033] [Example 5]

Although the adsorption-treatment test meal article additive colorant of a colorant (edible red No. (FUROKISHIN) 104) is used for the purpose of beautification of food, or color imitation of natural color, what the present use is accepted in with synthetic tar system coloring matter is only water-soluble acidic dye, such as red No. 104, and the use is also restricted.

[0034] Sausage 20g was broken finely, konnyaku 0.5g containing activated carbon and 100ml of water manufactured in the example 1 were added, it agitated for 10 minutes, and the adsorption treatment was performed. After adding the warm water for 5 times and dissolving, centrifugal separation was carried out and supernatant liquor was made into the testing liquid. This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 146-149th ] publication, and was judged with paper chromatography.

[0035] By the case where the konnyaku containing activated carbon is mixed, it was not detected to the edible red No. 104 having been detected in the control processed on the same conditions other than not adding the konnyaku containing activated carbon.

[0036] [Example 6]

Carcinogenic and teratogenesis formation are accepted by the adsorption-treatment examination orthophenyl phenol of preservatives (orthophenyl phenol (OPP)) like Chillan vender ZORU (TBZ). These preservatives have a growth prevention operation to mold, various kinds of aerotropism, and anaerobic bacteria, and are used for the wide range processed food.

[0037] 50g of samples which carried out the mincement of the orange was extracted to the beaker, about 100ml of water was added, and alginic-acid calcium gel ball 1g containing activated carbon further manufactured in the example 2 was added, and it agitated for 10 minutes and mixed. This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 142-143rd ] publication, and the fixed quantity of the orthophenyl phenol concentration was carried out with the gas chromatography.

[0038] In the case where the alginic-acid calcium gel ball containing activated carbon is mixed to 10.05 ppm orthophenyl phenol having been detected in the control processed on the same conditions, it was below the limit of determination (0.01 ppm) except not adding the alginic-acid calcium gel ball containing activated carbon.

[0039] [Example 7]

The adsorption-treatment examination antioxidant of an antioxidant (dibutyl hydroxy toluene (BHT)) has effects, such as prevention of loss of flavor, maintenance of the nutritive value of the food which deteriorates by oxidization, prevention of suntan of a processed marine product, and brown prevention of coloring matter, in everything but preventing acidification of fats and oils, and is used for it by the food of varieties.

[0040] Alginic-acid calcium 1g containing activated carbon manufactured in chewing gum 5g, NaCl 50g, pyrogallol 0.2g, 200ml of water, boiling tips, and the example 2 was put into the 500ml eggplant type flask, and the continuous extraction was connected and carried out to the continuous-extraction machine with a reflux condenser. This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 158-159th ] publication, and the fixed quantity of the dibutyl hydroxy toluene concentration was carried out with the gas chromatography.

[0041] In the case where the alginic-acid calcium gel ball containing activated carbon is mixed to the 0.35g [ /kg ] dibutyl hydroxy toluene having been detected in the control processed on the same conditions, it was below the limit of determination (0.01g/(kg)) except not adding the alginic-acid



calcium gel ball containing activated carbon.

[0042] [Example 8]

Although the adsorption-treatment examination hydrogen peroxide of antimicrobial agent (hydrogen peroxide) had a powerful oxidization operation and sterilizing properties, though it was feeble to the duodenum at the internal use to a mouse, since generating of cancer was accepted, use has been restricted and it has been used only for the dried herring roe now.

[0043] the dried herring roe which carried out mincement -- after stirring violently for 3 minutes, having taken about 5g, having put into the cup for grinding, having added 40ml of liquid for exudation, and ice-cooling from an outside, konnyaku 0.3g containing activated carbon manufactured in the example 1 was added, and it mixed further for 5 minutes. The air bubbles which added 0.1ml of silicone and generated it were removed, and it often [ after adding water and being referred to as 50ml ] stirred, and filtered. The filtrate threw away 5ml of the beginning and made it the testing liquid as it was. This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 144-145th ] publication, and the fixed

quantity of the hydrogen-peroxide concentration was carried out by oxygen potential measurement.

[0044] In the case where the konnyaku containing activated carbon is mixed to 0.85 ppm orthophenyl phenol having been detected in the control processed on the same conditions, it was below the limit of determination (0.01 ppm) except not adding the konnyaku containing activated carbon.

[0045] [Example 9]

In addition to the bleaching effect, since the adsorption-treatment experiment sulfurous acid of a bleaching agent (sulfurous acid) and its salts have effects, such as preservation and antioxidizing, they are used for much food as an additive, and are regulated as an amount of survival of a sulfur dioxide according to each food.

[0046] 0.2g of dried gourd strips which carried out mincement was taken, konnyaku 0.2g containing activated carbon and 20ml of distilled water manufactured in the example 1 were added, churning mixing was carried out for 10 minutes, and it considered as the sample. This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 150-151st ] publication, and the fixed quantity of the sulfurous-acid concentration was carried out by the improvement RANKIN method.

[0047] In the case where the konnyaku containing activated carbon is mixed to the 200 ppm sulfurous acid having been detected in the control processed on the same conditions, it was below the limit of determination (160 ppm) except not adding the konnyaku containing activated carbon.

[0048] [Example 10]

25g of bull meat which carried out \*\*\*\* medication of the adsorption-treatment experiment estradiol of a female sex hormone (estradiol) was extracted, water was added, and the whole quantity was set to 50g. Konnyaku 7g containing activated carbon manufactured in the example 1 was added to this, centrifugal separation was carried out by 5000rpm after churning for 30 minutes, and the supernatant was made into the sample. According to the RIA (Radioimmunoassay) radiation immunoassay method (work Kanehara & Co., Ltd. [ edited by 30th edition Masamitsu Kanai of "clinical test method \*\*\*\*" revision ], Inc. the 818th page), estradiol concentration was measured for this using the estradiol measurement kit (estradiol = antibody kit; product made from Japanese DPC).

[0049] In the case where the bread containing activated carbon is mixed to the 300 pg/ml estradiol having been detected in the control processed on the same conditions, it was below the limit of determination (5 pg/ml) except not adding the konnyaku containing activated carbon.

[0050] [Example 11]

Eight kinds are registered as three kinds and a herbicide as 35 kinds and a germicide as a present insecticide, and the adsorption-treatment examination organophosphorus compounds of organophosphorus compounds (diazinon) are widely used by the low residual property and low toxicity.

[0051] split apple 20g -- acetone 100ml -- it put into inside and mixed for 5 minutes with the high-speed homogenizer Alginate-acid calcium gel ball 1g containing activated carbon manufactured in the example

2 was added to this, and churning mixing was carried out for 5 minutes. Next, it filtered by the Kiriyaama funnel (5mm of filter aid), and extraction filtration was similarly carried out by water acetone 100ml 30 more%. The obtained filtrate was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 94-95th ] publication, and the fixed quantity of the diazinon concentration was carried out with the gas chromatography.

[0052] In the case where the alginic-acid calcium gel ball containing activated carbon is mixed to 0.01 ppm diazinon having been detected in the control processed on the same conditions, it was below limit of detection (10ppb) except not adding the alginic-acid calcium gel ball containing activated carbon.

[0053] [Example 12]

Although the adsorption-treatment examination chlorinated organic compound of a chlorinated organic compound (chloro SARONIRU (TPN)) became a problem in respect of toxicity and the residual property and it became a disable now [ most ], chloro SARONIRU (TPN), PCNB, a phthalimide system, and chlorbenzilate are also used as a germicide and a miticide now.

[0054] split cucumber 20g -- acetone 100ml -- after mixing [ be / under adding / it ] for 5 minutes with a high-speed homogenizer, alginic-acid calcium gel ball 1g containing activated carbon manufactured in the example 2 was added, and churning mixing was carried out for 10 minutes The obtained extract was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 96-99th ] publication, and the fixed quantity of the chloro SARONIRU concentration was carried out with the gas chromatography.

[0055] In the case where the alginic-acid calcium gel ball containing activated carbon is mixed to 2.019 ppm chloro SARONIRU having been detected in the control processed on the same conditions, it was below the limit of determination (0.001 ppm) except not adding the alginic-acid calcium gel ball containing activated carbon.

[0056] [Example 13]

Eight kinds of adsorption-treatment examination KABA mate agents of a KABA mate agent are registered as 11 kinds and a herbicide as an insecticide, and are used as an insecticide with organophosphorus compounds with low toxicity and the low residual property. [ many ]

[0057] split tomato 20g -- acetone 100ml -- after mixing [ be / under adding / it ] for 5 minutes with a high-speed homogenizer, konnyaku 1g containing activated carbon manufactured in the example 1 was added, and churning mixing was carried out for 10 minutes The obtained extract was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 102-103rd ] publication, and the fixed quantity of the KABA mate agent concentration was carried out with the gas chromatography.

[0058] In the case where the konnyaku containing activated carbon is mixed to the 0.850 ppm KABA mate agent having been detected in the control processed on the same conditions, it was below the limit of determination (0.001 ppm) except not adding the konnyaku containing activated carbon.

[0059] [Example 14]

The adsorption-treatment examination solanine of naturally occurring poison (solanine) is an alkaloid glycoside which exists in the sprout portion of a potato. LD50 is 0.45g/kg in rabbit taking orally, and, in the case of a man, causes poisoning by 0.2-0.4g.

[0060] potato 5g which carried out the split -- methanol 30ml -- after putting into inside and homogenizing for 5 minutes, alginic-acid calcium gel ball 0.5g containing activated carbon manufactured in the example 2 was added, and it agitated for 5 minutes The obtained extract was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 82-83rd ] publication, and the fixed quantity of the solanine concentration was carried out by liquid chromatography.

[0061] In the case where the alginic-acid calcium gel ball containing activated carbon is mixed to 80 ppm solanine having been detected in the control processed on the same conditions, it was below limit of detection (0.001 ppm) except [ all ] not adding the alginic-acid calcium gel ball containing activated

carbon by the above-mentioned operation.

[0062] [Example 15]

The fishes of lean, such as a mackerel which is easy to cause method food poisoning of adsorption-treatment examination allergy of a histamine, a horse mackerel, and a Pacific saury, have the high histidine content of isolation in muscles. A histamine will be accumulated if polluted with bacteria with weak histaminase activity with these fish meat strong [ histidine decarboxylase activity ].

[0063] 15ml of water was added to 10g of muscles of a mackerel, and it homogenized for 5 minutes.

Alginic-acid calcium gel ball 1g containing activated carbon furthermore manufactured in the example 2 was put in, and it agitated for 10 minutes and mixed. The obtained solution was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 134-135th ] publication, and the fixed quantity of the histamine concentration was carried out by liquid chromatography.

[0064] In the case where the calcium-alginate gel ball containing activated carbon is mixed to the histamine (280mg / 100g) having been detected in the control processed on the same conditions, it was below the limit of determination (2.5mg / 100g) except not adding the calcium-alginate gel ball containing activated carbon.

[0065] [Example 16]

The adsorption-treatment experiment cadmium of cadmium is widely distributed over a nature, and is used industrially and in large quantities, and the environmental pollution accompanying it and the cadmium pollution to the human body through food are regarded as questionable. When extensive ingestion is carried out by taking orally, in chronic intoxication according [ acute digestive trouble ] to ingestion of a minute amount, nephropathy produces cadmium. The one-day intake of Japanese cadmium is 30-60microg about, and it is presumed that the 30 - 40% is from rice.

[0066] After adding 40ml of distilled water for konnyaku 3g containing activated carbon manufactured in 10g of fine powder brown rice, and the example 1 for the reactor and adding a sulfuric acid further, it heated gradually. It cooled, when decomposition liquid became light yellow transparence, and distilled water was added further, the whole quantity was set to 100ml, and it considered as the testing liquid.

This was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 126-127th ] publication, and the fixed quantity of the cadmium was carried out by the atomic-absorption photometry.

[0067] In the case where the konnyaku containing activated carbon is mixed to the 0.5 ppm sulfurous acid having been detected in the control processed on the same conditions, it was below the limit of determination (0.02 ppm) except not adding the konnyaku containing activated carbon.

[0068] [Example 17]

The adsorption-treatment examination diethylene glycol (DEG) of a diethylene glycol (DEG) is used as solvents, such as the antifreezing solution for automobiles, a brake oil compounding agent, a cellophane softening agent, and rubber, fats and oils, etc., and, in the case of Homo sapiens, the toxicity is set to LD501000mg/kg by taking orally. It became clear for it to be mixed by the wine from a foreign country for the purpose of the jetty ring recall to which use is not permitted as a food additive in Showa 60 increasing KOKU and the sweet taste of wine, and to be imported also to our country, and it became a problem.

[0069] The diethylene glycol was melted to the methanol so that it might become in ml and 100microg /, and 100g of solutions was prepared. 40g of this solution was extracted, churning mixing was carried out for 10 minutes with konnyaku 3g containing activated carbon manufactured in the example 1, and the diethylene glycol was adsorbed. After condensing the obtained extract at 45 degrees C, water was added and it prepared to 10ml. When this was processed according to edit besides "food sanitation detection method seen by the eye" Misao Haruta, Chuo Hoki Shuppan Co., Ltd., and the method of a page [ 114-115th ] publication and the fixed quantity of the diethylene-glycol concentration was carried out with the gas chromatography, diethylene-glycol concentration was below limit of detection (10 ppm).

[0070] [Example 18]

Adsorption-treatment test adult male 20 of an acetaldehyde Konnyaku 10g containing activated carbon which ten persons manufactured in the example 1 just before drinking was eaten about the name, and other ten persons took in the one-person an average of 500ml alcoholic beverage (sake, 16% of alcoholic content) to \*\*\*\*\* in 2 hours.

[0071] The person to whom the temper became bad or it felt the konnyaku containing activated carbon in \*\*\*\* ten groups which are not and felt nauseated before drinking, when the condition of the everybody after drinking was observed is having been immediately after drinking and having been eight persons after six persons and 12 hours. The person to whom the temper became bad or it felt nauseated was immediately after drinking, and there was among ten groups which received and ate the konnyaku containing activated carbon before drinking after zero person and 12 hours. [ zero ]

[0072]

[Effect of the Invention] Since the adsorption-treatment agent of the toxic substance of this invention consists of a dispersed system which distributed particle activated carbon uniformly in the gel dispersion medium, adsorption capacity is high and can carry out the adsorption treatment of the toxic substance to high rate extremely.

[0073] Moreover, since the adsorption-treatment agent of the toxic substance of this invention is making the gel matter permitted physiologically carry out distributed content of the particle activated carbon, or it adheres or contains it for food etc. by making food etc. contact or prescribing a medicine for the patient into a direct digestive system, it can carry out the adsorption treatment of the toxic substance which exists in a digestive system simple.

[0074] The same effect is also acquired also by mixing the adsorption-treatment agent of the toxic substance of this invention to a processed food etc., or mixing activated carbon in a processed food etc. directly.

[0075] since the adsorption-treatment agent of the toxic substance of this invention did so the effect which was excellent in the above, or it adhered or contained for food etc., it used for adsorption treatments, such as the food additive which exists in a digestive system, a feed additive, agricultural chemicals, naturally occurring poison, allergen, heavy metal, or a strong toxic organic compound, the adsorption treatment of the surplus nutrient which exists in a digestive system, the adsorption treatment of the intermediate product of the alcohol generated in an after [ alcoholic ingestion ] digestive system, etc. -- a case -- especially -- being useful

[0076]

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[Translation done.]

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L10: Entry 1 of 2

File: JPAB

Mar 25, 1997

PUB-NO: JP409075723A  
DOCUMENT-IDENTIFIER: JP 09075723 A  
TITLE: HARMFUL MATTER ADSORBING AND REMOVING AGENT

PUBN-DATE: March 25, 1997

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COUNTRY

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APPL-NO: JP07184483

APPL-DATE: July 20, 1995

INT-CL (IPC): B01 J 20/20; A23 K 1/175; A23 L 1/03; A23 L 1/30; A61 K 33/44; A61 K 47/32; A61 K 47/36

## ABSTRACT:

PROBLEM TO BE SOLVED: To provide an agent capable of adsorbing and removing a harmful matter depositing on or contained in food, etc., or present in a digestive system at an extremely high rate by bringing the agent in direct contact with food, etc., and giving the agent directly in the digestive system.

SOLUTION: An activated carbon having 5 $\mu$ m to 10mm grain diameter is dispersed by 0.02-90wt.% in a physiologically allowable gel dispersion medium such as the bivalent metal salt of a high molecular polycarboxylic acid, bean curd, jelly, konjak, snow bell, gelidium jelly and chitosan-oxalate gel to obtain the harmful matter adsorbing and removing agent. Accordingly, the agent is useful in adsorbing and removing the food additive, feed additive, agricultural chemical, natural poison, allergen, heavy metal, highly poisonous org. compd., etc., depositing on or contained in food, etc., the excess nutrient present in the digestive system and the intermediate metabolite of alcohol, etc., formed in the digestive system after drinking alcohol.

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L6: Entry 47 of 51

File: DWPI

Mar 25, 1997

DERWENT-ACC-NO: 1997-239860  
DERWENT-WEEK: 199722  
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TITLE: Absorbing agent for removal of harmful substances from e.g. food - prepared  
by dispersion of active charcoal in physiological acceptable gel

PATENT-ASSIGNEE:

ASSIGNEE

TANKI BUSSAN KK

CODE

TANKN

PRIORITY-DATA: 1995JP-0184483 (July 20, 1995)

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47/36; B01 J 20/20

ABSTRACTED-PUB-NO: JP09075723A

BASIC-ABSTRACT:

An absorbing agent for removal of harmful substances is prepared by dispersion of active charcoal having particle size of 5 micron to 10mm, particularly 5 micron to 0.5mm, in a physiologically acceptable gel form dispersing medium at concentrations of 0.02-90, particularly 0.02-60 weight %.

Process is carried out to give the products. The resultant absorbent is added in a variety of conventional foods and feeds.

ADVANTAGE - Foods and feeds are obtained without fear of toxic substance. The medium contains bivalent metal salt of polymer polycarboxylic acids, particularly Ca salts, especially Ca alginate. The medium is soybean curd, jelly, konjak mannan, agar, ego, sea weed jelly or chitosan oxalate gel. The harmful substances are in food and feed additives, agricultural chemicals, natural poisons, allergens, heavy metals and toxic organic chemicals, particularly excessive nutrients and intermediate metabolites of alcohol. Processed foods and feeds contain the agents at concentrations of 0.01-60 weight %.

In an example, In 16g of refined konjak powder, 4g of active charcoal of 15 micron diameter and 750ml of warm water at 30 degree C and heated for 5 minutes with stirring for 7-8 minutes. The mixture was cooled to 40 degree C and fine powder of CaO dissolved in 50ml of warm water was added, then the mixture was heated in boiling water for 30 minutes, cooled and cut to pieces of konjak.

CHOSEN-DRAWING: Dwg.0/0

TITLE-TERMS: ABSORB AGENT REMOVE HARM SUBSTANCE FOOD PREPARATION DISPERSE ACTIVE  
CHARCOAL PHYSIOLOGICAL ACCEPT GEL

DERWENT-CLASS: A97 C07 D14 J01

CPI-CODES: A12-W11D; C04-C03B; C05-A01B; C05-C06; C14-M01; D04-A01F; D04-B06;  
D04-B07; J01-D01;

CHEMICAL-CODES:

Chemical Indexing M1 \*01\*

Fragmentation Code

J0 J011 J2 J221 J5 J581 K0 K4 K421 L5

L560 M210 M211 M262 M280 M281 M320 M423 M430 M782

M903 M904 Q130 Q224 Q431 V733 V734 V735

Specific Compounds

24070M

Chemical Indexing M1 \*02\*

Fragmentation Code

A220 A960 C710 J0 J011 J1 J111 M423 M430 M630

M782 M903 M904 M910 Q130 Q224 Q431 V733 V734 V735

Specific Compounds

11203M

Registry Numbers

1866U

Chemical Indexing M1 \*03\*

Fragmentation Code

H1 H100 H121 K0 L8 L814 L834 M423 M430 M782

M903 M904 Q130 Q224 Q431 V733 V734 V735

Specific Compounds

03882M

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D23 D22 D31 D42 D50 D76 D86 F08 F07 F24 F28 F26 F34 H0293 P0599 G3623 M2313 ; R11203  
R07226 P0599 G3623 D01 D23 D31 D42 D50 D61 D76 D86 F24 F28 F26 F34 F35 F36 Ca 2A H0293 ;  
S9999 S1365 Polymer Index [1.2] 018 ; F37 F35 F38 D61\*R Gm Ca 2A ; P0000 ; H0000 ; H0011\*R ;  
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(54)【発明の名称】 有害物質の吸着除去剤

(57)【要約】

【課題】 直接食品等に接触させまたは直接消化器系内に投与することにより、食品等に付着もしくは含有されるまたは消化器系内に存在する有害物質を極めて高率に吸着除去しうる有害物質の吸着除去剤を提供する。

【解決手段】 粒径5 $\mu$ m~10mmの活性炭を高分子ポリカルボン酸の二価金属塩、豆腐、ゼリー、コンニャク、寒天、エゴ、トコロテン、キトサンシュウ酸塩ゲル等の生理学的に許容されるゲル状分散媒中に0.02~90重量%分散させてなる有害物質の吸着除去剤である。

【効果】 食品等に付着もしくは含有されるまたは消化器系内に存在する食品添加物、飼料添加物、農薬類、自然毒、アレルギー、重金属または毒性の強い有機化合物等、消化器系内に存在する余剰栄養素、アルコール摂取後消化器系内に生成するアルコールの中間代謝物等の吸着除去に有用である。



## 【特許請求の範囲】

【請求項1】 粒径 $5\mu\text{m}$ ～ $10\text{mm}$ の活性炭を生理学的に許容されるゲル状分散媒中に $0.02$ ～ $90$ 重量%分散させてなる有害物質の吸着除去剤。

【請求項2】 前記生理学的に許容されるゲル状分散媒が高分子ポリカルボン酸の二価金属塩である請求項1記載の有害物質の吸着除去剤。

【請求項3】 前記高分子ポリカルボン酸の二価金属塩がカルシウム塩である請求項2記載の有害物質の吸着除去剤。

【請求項4】 前記高分子ポリカルボン酸の二価金属塩がアルギン酸カルシウムである請求項2記載の有害物質の吸着除去剤。

【請求項5】 前記生理学的に許容されるゲル状分散媒が豆腐、ゼリー、コンニャク、寒天、エゴ、トコロテンまたはキトサンシュウ酸塩ゲルである請求項1記載の有害物質の吸着除去剤。

【請求項6】 前記有害物質が食品もしくは飼料に付着もしくは含有されるまたは消化器系内に摂取された食品添加物、飼料添加物、農薬類、自然毒、アレルゲン、重金属または毒性の強い有機化合物である請求項1～5記載の有害物質の吸着除去剤。

【請求項7】 前記有害物質が消化器系内に摂取された余剰栄養素である請求項1～5記載の有害物質の吸着除去剤。

【請求項8】 前記有害物質がアルコール摂取後消化器系内に生成するアルコールの中間代謝物である請求項1～5記載の有害物質の吸着除去剤。

【請求項9】 請求項1～8記載の有害物質の吸着除去剤を $0.01$ ～ $60$ 重量%混入した加工食品または飼料。

【請求項10】 粒径 $5\mu\text{m}$ ～ $0.5\text{mm}$ の活性炭を $0.02$ ～ $60$ 重量%混入した加工食品または飼料。

【請求項11】 乳製品、水産練り製品、魚介類加工品、食肉加工品、豆製品、野菜加工品、芋加工品、穀物加工品、甘味類、油脂類または菓子類である請求項9または10記載の加工食品。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、食品等に付着もしくは含有されるまたは消化器系内に存在する有害物質の吸着除去剤に関する。

## 【0002】

【従来の技術】活性炭は、比表面積が大きく高い吸着能を示し、代表的な吸着剤として各種用途に使用されている。しかし、活性炭をゲル状物質または固形食品中に分散させた有害物質の吸着除去剤を、直接食品等に接触させるまたは直接消化器系内に投与する態様で利用した例は見当たらない。

## 【0003】

【発明が解決しようとする課題】本発明者らは、後述するように、微粒子活性炭の存在下における植物細胞の培養試験において、活性炭の細胞への移動、取り込みは起こらないものの、活性炭が核になって細胞集塊が形成されることを確認した。このことは、消化器系内において、個々の細胞内には微粒子活性炭は取り込まれないが、細胞がコロニーを形成する際に細胞間隙物質内に取り込まれ易く、細胞コロニーから微粒子活性炭を分離することが困難となることを示唆するものである。また、動物細胞では、細胞膜外層の蛋白または糖蛋白に微粒子活性炭が吸着されることも知られている。したがって、微粒子活性炭を有害物質の吸着除去剤として直接消化器系内に投与した場合、これを完全に消化器系外に排出させることが極めて難しいと考えられる。

【0004】本発明者らは、直接消化器系内に投与可能な有害物質の吸着除去剤について鋭意研究を重ねた結果、微粒子活性炭を生理学的に許容されるゲル状物質または固形食品中に分散含有させたものが、種々の有害物質に対し極めて高い吸着能を有し、しかも、これらが消化器系内に直接投与された場合、細胞膜外層の蛋白または糖蛋白に吸着されることなく容易に消化器系外に排出されうることを知り、本発明を完成した。

【0005】本発明の目的は、直接食品等に接触させまたは直接消化器系内に投与することにより、食品等に付着もしくは含有されるまたは消化器系内に存在する有害物質を極めて高率に吸着除去しうる有害物質の吸着除去剤を提供することにある。

## 【0006】

【課題を解決するための手段】本発明は、粒径 $5\mu\text{m}$ ～ $10\text{mm}$ の活性炭を生理学的に許容されるゲル状分散媒中に $0.02$ ～ $90$ 重量%分散させてなる有害物質の吸着除去剤に関する。

【0007】本発明の有害物質の吸着除去剤は、微粒子活性炭をゲル状分散媒中に均一に分散させた分散系からなるので、活性炭単独で使用するよりも吸着剤全体としての有効吸着面積が増加し吸着能が増大して、有害物質を極めて高率に吸着除去することができる。

【0008】また、本発明の有害物質の吸着除去剤は、微粒子活性炭を生理学的に許容されるゲル状物質に分散含有させているので、消化器系内に直接投与することができ、食品等に混入されて消化器系内に摂取された有害物質を消化器系内において簡便に吸着除去することができる。しかも、消化器系内の有害物質を吸着除去した後の吸着剤は、極めて速やかに容易に消化器系外に排出されうるものである。

【0009】また、本発明の有害物質の吸着除去剤は、食品等に混合接触させて食品等に含まれる有害物質を吸着除去することもできる。この場合、活性炭を単独で食用した場合に比べ、有害物質を吸着除去後の吸着剤を食品から簡単に短時間で分離することができる。さらに、

誤って吸着剤が分離されずに食品等に混入して消化器系内に摂取されたとしても、上述のように迅速に消化器系外に排出されるので安全である。

【0010】本発明の有害物質の吸着除去剤は、上述のように消化器系内に直接投与して利用するほか、加工食品等に混合して利用することもできる。また、本発明の有害物質の吸着除去剤と同様の効果は、加工食品等に活性炭を直接混入することによっても得られる。

【0011】本発明の有害物質の吸着除去剤は、人体に有害な物質の吸着除去剤としてヒトに対して利用できるほか、飼養動物に対しても利用することができる。すなわち、本発明の吸着除去剤を用いて飼料を処理し、または本発明の吸着除去剤を直接もしくは飼料に混合することにより飼養動物に投与して利用できる。

【0012】

【発明の実施の形態】本発明の一つは、粒径 $5\mu\text{m}$ ~ $10\text{mm}$ の活性炭を生理学的に許容されるゲル状分散媒中に0.02~90重量%分散させてなる有害物質の吸着除去剤である。

【0013】本発明の有害物質の吸着除去剤において使用する活性炭の粒径は、 $5\mu\text{m}$ ~ $10\text{mm}$ がよい。活性炭の粒径が $5\mu\text{m}$ 未満では取り扱いが困難になり、 $10\text{mm}$ を超えると活性炭の単位重量当たりの吸着能が低下する。

【0014】また、分散媒中への活性炭の混合量は0.02~90重量%がよい。活性炭の混合量が0.02重量%未満では吸着効果が低く、90重量%を超えるとゲル状分散倍中に分散させることが困難になる。

【0015】本発明の有害物質の吸着除去剤において使用する生理学的に許容されるゲル状分散媒としては、消化器系内に投与しても無害なゲル状物質、たとえば高分子ポリカルボン酸の二価金属塩が挙げられる。高分子ポリカルボン酸の二価金属塩としては、アルギン酸、ペクチン酸、カルボキシメチルセルロース、カルボキシメチルキチン、スチレン-マレイン酸共重合体、スチレン-マレイン酸半アルキルエステル共重合体、エチレン-アクリル酸共重合体、ポリアクリル酸、ポリメタクリル酸、アクリル酸-メタクリル酸共重合体、アクリル酸-マレイン酸共重合体、アクリル酸-マレイン酸半アルキルエステル共重合体等、側鎖にカルボキシル基を有する高分子化合物のカルシウム、マグネシウム、鉄、銅塩等が挙げられる。

【0016】高分子ポリカルボン酸の二価金属塩を用いた吸着除去剤は、高分子ポリカルボン酸のアルカリ金属塩またはアンモニウム塩と活性炭の懸濁液を二価金属塩水溶液中に滴下することにより得られる。上記懸濁液の高分子ポリカルボン酸のアルカリ金属塩またはアンモニウム塩の濃度は0.01~5モルがよく、下限未満では活性炭を分散するしっかりしたゲルが得られず、上限を超えると活性炭をとりまく高分子ポリカルボン酸塩が多

く、被吸着物の吸着体内部への進入が阻害され吸着能が著しく低下する。また、二価金属塩水溶液の濃度は0.05~5モルがよく、下限未満では架橋率が少なく吸着体の強度が弱くなり、上限を超える架橋率が大きくなり吸着体の孔径が極めて小さくなり、被吸着体が吸着体内部へ進入しにくくなる。

【0017】また、本発明においては、生理学的に許容されるゲル状分散媒として、豆腐、ゼリー、コンニャク、寒天、エゴまたはトコロテン等のゲル状食品、キトサンシュウ酸塩ゲル等を用いることもできる。これらの分散媒を用いた吸着除去剤は、それぞれのゲル状食品の製造過程でゲル形成前に活性炭を適宜添加し分散させることにより得られる。

【0018】本発明の有害物質の吸着除去剤は、食品もしくは飼料に含有されるまたは消化器系内に摂取された食品添加物、飼料添加物、農薬類、自然毒、アレルギー、重金属、毒性の強い有機化合物等を吸着除去するのに用いることができる。食品添加物としては、サッカリンおよびその塩類、グリチルリチン酸二カリウム、グリチルリチン酸三カリウム、アセト酢酸エチル等の甘味料、三酸化鉄、食用赤色3号、40号、102号、104号、105号、106号、食用黄色4号、5号、食用緑色3号、食用青色1号、2号、二酸化チタン等の着色料、安息香酸、オルトフェニルフェノール、ソルビン酸、デヒドロ酢酸、プロピオン酸およびそれらの塩類、ジフェニル、チアベンダゾール、パラオキシ安息香酸エステル類等の保存料、プロピレングリコール等の品質保持剤、アルギン酸プロピレングリコール、カルボキシメチルセルロースカリウム、カルボキシメチルセルロースナトリウム、デンブングリコール酸ナトリウム、デンブリン酸エステルナトリウム、メチルセルロース、ポリアクリル酸ナトリウム等の増粘剤・安定剤・ゲル化剤・糊料、 $\text{dl-}\alpha$ -トコフェロール、ニリソルビン酸およびそのナトリウム塩、グアヤク脂、クエン酸イソプロピル、ジブチルヒドロキシルエーテル、ノルジヒドログアヤレチック酸、ブチルヒドロキシアニソール、没食子酸プロピル、エチレンジアミン四酢酸カルシウム二ナトリウム、エチレンジアミン四酢酸二ナトリウム等の酸化防止剤、亜硝酸ナトリウム、硝酸カリウム、硝酸ナトリウム、硫酸第一鉄、リン酸塩等の発色剤、過酸化水素、次亜塩素酸、次亜塩素酸ナトリウム等の殺菌剤、亜硫酸およびその塩類等の漂白剤、オルトフェニルフェノールおよびその塩類、ジフェニル、チアベンダゾール等の防カビ・防ばい剤、女性ホルモン等のホルモン等が挙げられる。農薬類としては、MEP、ダイアジノン、PAP、IBP、EDDP、DDVP、DEP、マラソン、EPN等の有機リン、クロロサロニル、クロルピクリン、D-D、ピラゾレート、PCNB、フラサイド、DCI-P、プロシモン等の有機塩素、BPMC、MTMC、XMC、MCC、MIPC等のカーバメート、臭化メチ

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ル等の有機臭素、チオファネートメチル等のベンゾイミダゾール、ベンチオカーブ等のチオカーバメイト、CNP等のジフェニルエーテル、塩素酸塩等の塩素、キャプタン等のフタルイミド、マンネブ等のジチオカルバメート、パラコート等のビピリジウム、クロメトキシニル等のジフェニルエーテル、DCPA等の酸アミド、無機銅等の銅、セトキシジム、イソプロチオラン、プロベナゾール、ダイムロン、ナプロアニリド等の殺菌剤、殺虫剤、除草剤等が挙げられる。自然毒としては、ジャがいもの新芽に含まれるソラニン、アルカロイド、青酸配糖体等が挙げられる。アレルゲンとしては、アレルギーよう食中毒の原因であり肉等の腐敗により生成するヒスタミン等が挙げられる。重金属としては、水銀、鉛、六角クロム、カドミウム、セレン、ヒ素、銅、鉄、亜鉛等が挙げられる。また、毒性の強い有機化合物としては、リン化合物、塩化物、ベンゼン等が挙げられる。

【0019】また、本発明の有害物質の吸着除去剤は、消化器系内に摂取された余剰栄養素を吸着除去するのにも使用することができる。後述するように、本発明の吸着除去剤は、細胞培養試験において培地中の栄養源を吸着することにより細胞増殖を抑制する働きがあり、食品等と一緒にまたは食前もしくは食後に摂取することにより食物等の代謝を抑制し抗肥満剤等としても利用することができる。

【0020】さらに、本発明の有害物質の吸着除去剤は、飲酒後消化器系内に生成するアルコールの中間代謝物であるアセトアルデヒド等を吸着除去するのにも用いることができる。すなわち、哺乳動物におけるアルコール（エチルアルコール）代謝は段階的に進行して中間代謝物としてアセトアルデヒドを生成し、アセトアルデヒドはついで酢酸とアセチル-C<sub>o</sub>Aに酸化される。これらのアルコール代謝において、アセトアルデヒドの濃度が高くなると悪心、嘔吐、顔面紅潮、心拍増加、拍動性頭痛、皮膚温上昇、最低血圧低下等の症状（アセトアルデヒド症状）が起こる。したがって、飲酒の際またはその前後に本発明の吸着剤を摂取し消化器系内に生成するアセトアルデヒドを吸着除去することによって、これらのアセトアルデヒド症状を予防または治療することができる。また、メタノール等の誤用による中毒症状もそのアルコールの中間代謝物に起因するものであるが、これらのアチドーシスの治療にも利用することができる。

【0021】本発明の他の一つは、上記有害物質の吸着除去剤を0.01～60重量%混入した加工食品または飼料である。

【0022】本発明の有害物質の吸着除去剤の加工食品等への混合量を0.01～60重量%としたのは、0.01重量%未満では十分な吸着能が得られず、60%を超えると食品等としての風合いや食感が得られず異物感がひどくなるからである。

【0023】吸着除去剤を混入する加工食品としては、

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ヨーグルト、チーズ等の乳製品、かまぼこ、ちくわ、はんぺん、さつま揚げ、なると、つみれ等の水産練り製品、でんぶ等の魚介類加工品、ソーセージ、フランクフルト、レバーペースト等の食肉加工品、豆腐、焼き豆腐、生揚げ、油揚げ、がんもどき、おから、凍り豆腐、湯葉等の豆製品、ピューレ等の野菜加工品、マッシュポテト、くず、はるさめ、こんにゃく、しらたき等の芋加工品、もち、白玉、白飯、麩、ビーフン、マカロニ、スパゲッティ、そうめん、そば、うどん、中華めん、食パン、乾パン、アンパン等の穀物の加工品、ジャム等の甘味類、バター、マーガリン、マヨネーズ、ドレッシング等の油脂類、あめ、らくがん、せんべい、あられ、カステラ、ようかん、もなか、まんじゅう、大福もち、だんご、ういろう、チョコレート、ビスケット、クッキー、ドーナツ、ケーキ、パイ、アイスクリーム、プリン、ゼリー、ババロア等の菓子類等が挙げられる。

【0024】本発明のさらに他の一つは、粒径5 $\mu$ m～0.5mmの活性炭を0.01～60重量%混入した加工食品または飼料である。

【0025】活性炭の粒径が5 $\mu$ m未満では取り扱いが困難になり、0.5mmを超えると食品等としての風合いや食感が得られず異物感がひどくなる。また、活性炭の加工食品等への混合量が制限されるのは、前記本発明の加工食品等における制限と同様の理由によるものである。また、活性炭を混入する加工食品としては、前記加工食品と同様のものが挙げられる。

【0026】

【実施例】

〔実施例1〕

30 活性炭入りコンニャクの製造

精粉16gと粒径約15 $\mu$ mの活性炭4gとをよく混ぜ、30℃の温水750mlに固まりができないように少量ずつ加え、攪拌しながら強火で約5分間加熱した。気泡がぶつぶつ吹き出すようになったのち中火にして7～8分間攪拌を続け、その後40℃程度まで冷却した。乳鉢でよくすり潰したCaOを40℃の温湯50mlに溶かしたものをこれに加え、全体を手早くこね、型箱に入れて指でよく押さえ内部の空気を抜いて均質にした。型箱ごと熱湯中に入れて約5分間加熱し、型箱から取り出してさらに25分間加熱を続けて完全に凝固させた。できあがった活性炭入りコンニャクを流水にさらしてあく抜きをし、約1mm<sup>3</sup>に細切し、実験試料とした。

【0027】〔実施例2〕

活性炭入りアルギン酸カルシウムゲルボールの製造

アルギン酸ナトリウム2gと粒径約15 $\mu$ mの活性炭3gとをよく混合し、攪拌下水800ml中に少量ずつ添加し、さらに水を加えて全量を1000mlとした。さらに24時間攪拌し、0.3%活性炭入りのアルギン酸ナトリウム溶液を調製した。別に塩化カルシウム11.1gを蒸留水800ml中に溶かし、さらに蒸留水を加

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えて重量を1000mlとし、1.11%塩化カルシウム溶液を調製した。

【0028】次に、0.3%活性炭入りのアルギン酸ナトリウム溶液を50mlのビューレットに注入し、1.11%塩化カルシウム溶液500ml中に1滴ずつ滴下し、活性炭入りアルギン酸カルシウムゲルボールの粗製品を得た。得られたゲルボールを集め、5lの容器に入れ、イオン交換水を流しつつ、10時間処理して未反応物および副生成物を除去して、活性炭入りアルギン酸カルシウムゲルボールを得た。

#### 【0029】[実施例3]

##### 活性炭入り食パンの製造

強力粉400g、粒径約15 $\mu$ mの活性炭4g、バター15g、スキムミルク8g、砂糖10g、塩7gおよびドライイースト4gを用い、ナショナル自動ホームベーカリー（松下電器産業株式会社製 SD-BT6）により4時間15分かけて製パンした。得られた活性炭入り食パンを食したところ、風味と食感は活性炭を入れない場合と比較して全く同じであった。

#### 【0030】[実施例4]

##### 種々の活性炭粒子の植物細胞への吸着性試験

モデル植物細胞としてCatharanthus roseus（ニチニチソウ）の培養細胞を用い、培地100mlを含む500ml三角フラスコで、回転振盪培養（120rpm）による細胞培養を行った。培地はMurashige Skoog (MS) 培地にSucrose（蔗糖）30g/lと植物生長調節物質である2,4-D 0.5mg/lを添加したものを用いた。粒径の大きい活性炭（粒径約5mm）、粒径の小さい活性炭（粒径約15 $\mu$ m）、実施例1で製造した活性炭入りコンニャクおよび実施例3で製造した活性炭入り食パンをそれぞれ培地に1.0%（W/V）になるように添加した。細胞の増殖量は、Packed cell volume（圧縮細胞量法、「植物細胞組織培養 実際・応用・展望 第一版」原田宏他編集、第55頁、1993年）により行った。

【0031】植物細胞は通常、単細胞の状態よりも数十から数千の細胞で構成される細胞集塊の状態でも多く存在する。培養14日目の細胞について顕微鏡観察を行った結果、粒径の大きい活性炭および粒径の小さい活性炭を添加したものは、ともに活性炭が核になり細胞集塊を形成したものが一部認められた。これに対し、本発明の活性炭入りコンニャクおよび活性炭入り食パンを添加したものではほとんど認められなかった。

【0032】また、いずれの場合も、細胞内部への活性炭の移動、吸収は認められなかった。細胞の増殖について見てみると、活性炭を添加した場合、いずれのタイプにおいても、細胞の増殖が約30%阻害されていた。この現象は培地中の栄養源が活性炭に吸着し、栄養源が不足したために生じたものと考察される。

#### 【0033】[実施例5]

##### 着色料（食用赤色104号（フロキシン））の吸着除去試験

食品添加物着色料は食品の美化または天然色の色彩模倣を目的に使用されているが、合成タール系色素で現在使用が認められているものは赤色104号等の水溶性酸性色素のみであり、その使用も制限されている。

【0034】ソーセージ20gを細かく砕き、実施例1で製造した活性炭入りコンニャク0.5gと水100mlを加え10分間攪拌し吸着処理を行なった。5倍用の温湯を加え溶解した後、遠心分離し、上澄液を試験溶液とした。これを、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第146～149頁に記載の方法に準じて処理し、ワットクロマトグラフィーにより判定した。

【0035】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは食用赤色104号が検出されたのに対し、活性炭入りコンニャクを混入した場合では検出されなかった。

#### 20 【0036】[実施例6]

##### 保存料（オルトフェニルフェノール（OPP））の吸着除去試験

オルトフェニルフェノールはチャンペンダゾール（TBZ）と同様発ガン性や催奇形成が認められる。この保存料はカビ類、各種の好気性および嫌気性菌に対して発育阻止作用があり、広範囲の加工食品に使用されている。

【0037】オレンジを細切りした試料50gをピーカーに採取し、水を約100ml加え、さらに実施例2で製造した活性炭入りアルギン酸カルシウムゲルボール1gを加え、10分間攪拌し混和した。これを「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第142～143頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりオルトフェニルフェノール濃度を定量した。

【0038】活性炭入りアルギン酸カルシウムゲルボールを加えない以外は同じ条件で処理したコントロールでは、10.05ppmのオルトフェニルフェノールが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合では、定量限界（0.01ppm）以下であった。

#### 40 【0039】[実施例7]

##### 酸化防止剤（ジブチルヒドロキシルエン（BHT））の吸着除去試験

酸化防止剤は油脂の酸敗を防ぐことの他に、風味の損失の防止、酸化により劣化する食品の栄養価の保持、水産加工品の日焼けの防止、色素の褐色防止等の効果があり、多種類の食品に使用されている。

【0040】チューインガム5g、NaCl50g、ヒロガロール0.2g、水200ml、沸騰石および実施例2で製造した活性炭入りアルギン酸カルシウム1gを

500mlのナス型フラスコに入れ、還流冷却器付の連続抽出器に接続し、連続抽出した。これを「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第158～159頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりジブチルヒドロキシトルエン濃度を定量した。

【0041】活性炭入りアルギン酸カルシウムゲルボールを加えない以外は同じ条件で処理したコントロールでは、0.35g/kgのジブチルヒドロキシトルエンが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合には、定量限界(0.01g/kg)以下であった。

#### 【0042】[実施例8]

殺菌料(過酸化水素)の吸着除去試験

過酸化水素は強力な酸化作用、殺菌力を有するが、マウスへの経口投与で十二指腸に微弱ながらがんの発生が認められて以来使用が制限され、現在はカズノコのみを使用されている。

【0043】細切りしたカズノコ約5gを採り、磨砕用カップに入れ、浸出液40mlを加え、外側から氷冷しながら3分間激しくかき混ぜた後、実施例1で製造した活性炭入りコンニャク0.3gを加え5分間さらに混合した。シリコンを0.1ml加えて生成した気泡を除去し、水を加えて50mlとした後よくかき混ぜろ過した。ろ液は最初の5mlを捨て、そのまま試験溶液とした。これを、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第144～145頁に記載の方法に準じて処理し、酸素電位測定により過酸化水素濃度を定量した。

【0044】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは、0.85ppmのオルトフェニルフェノールが検出されたのに対し、活性炭入りコンニャクを混入した場合には、定量限界(0.01ppm)以下であった。

#### 【0045】[実施例9]

漂白剤(亜硫酸)の吸着除去実験

亜硫酸およびその塩類は漂白効果以外に、保存、酸化防止などの効果を有するため、多くの食品に添加物として使用されており、各食品別に二酸化硫黄の残存量として規制されている。

【0046】細切りしたかんぴょう0.2gを採り、実施例1で製造した活性炭入りコンニャク0.2gと蒸留水20mlとを加え10分間攪拌混和し試料とした。これを、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第150～151頁に記載の方法に準じて処理し、改良ランキン法により亜硫酸濃度を定量した。

【0047】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは、200ppmの亜硫酸が検出されたのに対し、活性炭入りコンニャクを混

入した場合では、定量限界(160ppm)以下であった。

#### 【0048】[実施例10]

女性ホルモン(エストラジオール)の吸着除去実験

エストラジオールを混餌投与した雄牛肉25gを採取し、水を加えて全量を50gとした。これに実施例1で製造した活性炭入りコンニャク7gを加え、30分間攪拌後5000rpmで遠心分離し、上澄み液を試料とした。これを、RIA(Radioimmunoassay)放射免疫測定法(「臨床検査法提要」改訂第30版 金井正光編著 金原出版株式会社 第818頁)に従い、エストラジオール測定キット(エストラジオール=抗体キット;日本DPC製)を用いてエストラジオール濃度を測定した。

【0049】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは、300pg/mlのエストラジオールが検出されたのに対し、活性炭入り食パンを混入した場合には、定量限界(5pg/ml)以下であった。

#### 【0050】[実施例11]

有機リン剤(ダイアジノン)の吸着除去試験

有機リン剤は、現在殺虫剤として35種類、殺菌剤として3種類、除草剤として8種類が登録されており、低残留性、低毒性ということで広く利用されている。

【0051】細片リング20gをアセトン100ml中に入れ、高速ホモジナイザーで5分間混和した。これに、実施例2で製造した活性炭入りアルギン酸カルシウムゲルボール1gを加え5分間攪拌混和した。次に桐山製漏斗(ろ過助剤5mm)でろ過し、さらに30%含水アセトン100mlで同様に抽出ろ過した。得られたろ液を、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第94～95頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりダイアジノン濃度を定量した。

【0052】活性炭入りアルギン酸カルシウムゲルボールを加えない以外は同じ条件で処理したコントロールでは、0.01ppmのダイアジノンが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合には、検出限界(10ppb)以下であった。

#### 【0053】[実施例12]

有機塩素剤(クロロサロニル(TPN))の吸着除去試験

有機塩素剤は毒性、残留性の点で問題となり、現在はほとんど使用禁止となったが、クロロサロニル(TPN)、PCNB、フタルイミド系、クロルベンジレート類等は現在も殺菌剤、殺ダニ剤として使用されている。

【0054】細片キュウリ20gをアセトン100ml中に加え、高速ホモジナイザーで5分間混和した後、実施例2で製造した活性炭入りアルギン酸カルシウムゲルボール1gを加え10分間攪拌混入した。得られた抽出

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液を、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第96～99頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりクロロサロニル濃度を定量した。

【0055】活性炭入りアルギン酸カルシウムゲルボールを加えない以外は同じ条件で処理したコントロールでは、2.019ppmのクロロサロニルが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合は、定量限界(0.001ppm)以下であった。

## 【0056】[実施例13]

## カーバメート剤の吸着除去試験

カーバメート剤は、殺虫剤として11種類、除草剤として8種類登録されており、低毒性、低残留性ということと有機リン剤とともに殺虫剤として多く利用されている。

【0057】細片トマト20gをアセトン100ml中に加え、高速ホモジナイザーで5分間混和した後、実施例1で製造した活性炭入りコンニャク1gを加え10分間攪拌混入した。得られた抽出液を、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第102～103頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりカーバメート剤濃度を定量した。

【0058】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは、0.850ppmのカーバメート剤が検出されたのに対し、活性炭入りコンニャクを混入した場合は、定量限界(0.001ppm)以下であった。

## 【0059】[実施例14]

## 自然毒(ソラニン)の吸着除去試験

ソラニンはジャガイモの新芽部分に存在するアルカロイド配糖体である。LD50はウサギ経口で0.45g/kgであり、ヒトの場合0.2～0.4gで中毒を起こす。

【0060】細片したジャガイモ5gをメタノール30ml中に入れ5分間ホモジナイズした後、実施例2で製造した活性炭入りアルギン酸カルシウムゲルボール0.5gを加え5分間攪拌した。得られた抽出液を、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第82～83頁に記載の方法に準じて処理し、液体クロマトグラフィーによりソラニン濃度を定量した。

【0061】上記の操作で活性炭入りアルギン酸カルシウムゲルボールを加えない以外は全て同一条件で処理したコントロールでは、80ppmのソラニンが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合は、検出限界(0.001ppm)以下であった。

## 【0062】[実施例15]

## ヒスタミンの吸着除去試験

アレルギーよう食中毒の原因となりやすいサバ、アジ、

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サンマ等の赤身の魚類は、筋肉中の遊離のヒスチジン含有量が高い。これらの魚肉がヒスチジンデカルボキシラーゼ活性が強くヒスタミンナーゼ活性が弱い細菌によって汚染されるとヒスタミンが蓄積される。

【0063】サバの筋肉10gに水15mlを加えて5分間ホモジナイズした。さらに実施例2で製造した活性炭入りアルギン酸カルシウムゲルボール1gを入れ、10分間攪拌し混和した。得られた水溶液を、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第134～135頁に記載の方法に準じて処理し、液体クロマトグラフィーによりヒスタミン濃度を定量した。

【0064】活性炭入りアルギン酸カルシウムゲルボールを加えない以外は同じ条件で処理したコントロールでは、280mg/100gのヒスタミンが検出されたのに対し、活性炭入りアルギン酸カルシウムゲルボールを混入した場合は、定量限界(2.5mg/100g)以下であった。

## 【0065】[実施例16]

## カドミウムの吸着除去実験

カドミウムは、自然界に広く分布し、工業的にも大量に利用され、それに伴う環境汚染や、食品を介しての人体へのカドミウム汚染が問題視されている。カドミウムは経口により大量摂取をした場合には急性胃腸障害が、微量の摂取による慢性中毒では腎障害が生ずる。日本人のカドミウムの1日摂取量は、およそ30～60μgであり、その30～40%は米からであると推定されている。

【0066】細粉玄米10gと実施例1で製造した活性炭入りコンニャク3gを反応器にとり、蒸留水40mlを加え、さらに硫酸を加えた後、徐々に加熱した。分解液が淡黄色透明になったら冷却し、さらに蒸留水を加えて全量を100mlとし、試験溶液とした。これを、「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第126～127頁に記載の方法に準じて処理し、原子吸光光度法によりカドミウムを定量した。

【0067】活性炭入りコンニャクを加えない以外は同じ条件で処理したコントロールでは、0.5ppmの亜硫酸が検出されたのに対し、活性炭入りコンニャクを混入した場合は、定量限界(0.02ppm)以下であった。

## 【0068】[実施例17]

## ジエチレングリコール(DEG)の吸着除去試験

ジエチレングリコール(DEG)は、自動車用不凍液、ブレーキ油配合剤、セロハン柔軟剤、ゴム・油脂等の溶剤等として使用されており、その毒性はヒトの場合経口でLD501000mg/kgとされている。昭和60年食品添加物として使用が許可されていないジエチレングリコールがワインのkokと甘みを増すことを目的に外国産ワインに混和されわが国へも輸入されていることが判明し問題となった。

【0069】ジエチレングリコールを $100\mu\text{g}/\text{ml}$ となるようにメタノールに溶かし、溶液 $100\text{g}$ を調製した。この溶液 $40\text{g}$ を採取し、実施例1で製造した活性炭入りコンニャク $3\text{g}$ と $10$ 分間攪拌混和してジエチレングリコールを吸着した。得られた抽出液を $45^\circ\text{C}$ で濃縮した後水を加えて $10\text{ml}$ に調製した。これを、

「目で見える食品衛生検査法」春田三佐夫他編集、中央法規出版、第114～115頁に記載の方法に準じて処理し、ガスクロマトグラフィーによりジエチレングリコール濃度を定量したところ、ジエチレングリコール濃度は検出限界( $10\text{ppm}$ )以下であった。

#### 【0070】〔実施例18〕

アセトアルデヒドの吸着除去試験

成人男性 $20$ 名につき、 $10$ 名が飲酒直前に実施例1で製造した活性炭入りコンニャク $10\text{g}$ を食し、他の $10$ 名は食さずに、 $2$ 時間で $1$ 人平均 $500\text{ml}$ のアルコール飲料(日本酒、アルコール含有率 $16\%$ )を摂取した。

【0071】飲酒後各人の体調を観察したところ、飲酒前に活性炭入りコンニャクを食さない群 $10$ 人中、吐き気を催したまたは気分が悪くなった人は、飲酒直後で $6$ 人、 $12$ 時間後で $8$ 人であったのに対し、飲酒前に活性炭入りコンニャクを食した群 $10$ 人中、吐き気を催したまたは気分が悪くなった人は、飲酒直後で $0$ 人、 $12$ 時

間後で $0$ 人であった。

#### 【0072】

【発明の効果】本発明の有害物質の吸着除去剤は、微粒子活性炭をゲル状分散媒中に均一に分散させた分散系からなるので吸着能が高く、有害物質を極めて高率に吸着除去することができる。

【0073】また、本発明の有害物質の吸着除去剤は、微粒子活性炭を生理学的に許容されるゲル状物質に分散含有させているので、食品等に接触させまたは直接消化器系内に投与することにより、食品等に付着もしくは含有されるまたは消化器系内に存在する有害物質を簡便に吸着除去することができる。

【0074】本発明の有害物質の吸着除去剤を加工食品等に混合し、または加工食品等に活性炭を直接混入することによっても同様の効果も得られる。

【0075】本発明の有害物質の吸着除去剤は上記の優れた効果を奏するので、食品等に付着もしくは含有されるまたは消化器系内に存在する食品添加物、飼料添加物、農薬類、自然毒、アレルゲン、重金属または毒性の強い有機化合物等の吸着除去、消化器系内に存在する余剰栄養素の吸着除去、アルコール摂取後消化器系内に生成するアルコールの中間代謝物の吸着除去等に用いた場合特に有用である。

#### 【0076】

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